

Man in the Choshui and Tatu River Valleys in Central Taiwan: Preliminary Report of an Interdisciplinary Project, 1972-1973 Season

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GENERAL BACKGROUND AND DESIGN

OF THE total land area of Taiwan (ca. 35,960 km²) only about 31% is below 100 m in absolute altitude, but as much as 32% is above 1000 m. The average peak in the Central Mountain Range in fact reaches over 3000 m (C. H. Ch'en 1959-61: 52). This, in addition to the fact that the island lies exactly on the Tropic of Cancer off the coast of southeastern China, essentially accounts for the remarkable diversity of Taiwan's environmental conditions to which its ancient as well as modern inhabitants have had to adapt. Since Taiwan's prehistory is also characterized by a considerable degree of cultural diversity, an ecosystemically oriented research program taking advantage of this environmental and prehistoric complexity easily suggests itself as potentially worthwhile. And since Taiwan's academic world is staffed with competent professionals in the disciplines generally involved with cultural ecological and palaeoecological studies, such a program is also realistic.

K. C. Chang is affiliated with Yale University and Academia Sinica. Author's note: The author alone is responsible for any error in this paper, but his data come from the researches of many collaborators. See REFERENCES for full credits. The author and his collaborators sincerely thank Ch'ien Ssu-liang, President, Academia Sinica, and Yen Chen-hsing, President, National Taiwan University, for their encouragement and support. We also thank Hsü Yün-chi, of the Radiocarbon Laboratory, Department of Physics, National Taiwan University, for his invaluable assistance. The research project is supported by a grant awarded for 1972-74 by the National Science Council (Taipei) to Academia Sinica and the National Taiwan University. The author's participation in the project was made possible by a research grant (GS-28089) awarded by the National Science Foundation (Washington, D.C.)

In the summer of 1971 I began the task of designing such a research program and organizing a team. By that fall a team had been organized comprising scholars from seven fields. The principal investigators in the respective disciplines were Li Yih-yüan and Wang Sung-hsing, of the Institute of Ethnology, Academia Sinica, Taipei, for cultural anthropology; Lin Ch'ao-ch'i, of the Department of Geology, National Taiwan University (NTU), Taipei, for geology; Shih Tsai-t'ien, of the Department of Geography, National Normal University, Taipei, for geomorphology; Liang Jun-sheng, of the Department of Zoology, NTU, for zoology; Huang Tseng-ch'üan, of the Department of Botany, NTU, for botany and palynology; T'u Hsin-yüan, of the Soil Laboratory, U. S. Department of Agriculture, Beltsville, Maryland, for soil studies; and Kao Ch'ü-hsün, of the Department of Archaeology, Institute of History and Philology, Academia Sinica, Sung Wen-hsün, of the Department of Archaeology and Anthropology, NTU, and myself, of Yale University and (as Adjunct Research Fellow) of the Department of Archaeology, Institute of History and Philology, Academia Sinica, for archaeology. The research program would be administered under the auspices of Academia Sinica, NTU, and Yale, and by a committee of three consisting of myself, as Director; Wang, as Executive Secretary; and T'ang Mei-chün, of the Department of Archaeology and Anthropology, NTU. Grants to finance the research were awarded by the National Science Council (Humanities Section), of Taipei, for the entire project, and by the National Science Foundation, of Washington, D.C., for my part in it. The first phase of the program was designed for two years, 1972-74. All scientific collections resulting from this research would become the charge of the institution to which each of the chief scientists belonged. The archaeological collection would go to the Department of Archaeology, of the Institute of History and Philology.

What attracted these eminent scholars to this research program was not only its conceptual design but also the obvious and proven potential of the area selected for the research, namely, the Choshui and the Tatu River valleys in central Taiwan (Fig. 1). The Choshui is the longest river in Taiwan (167 km) and its drainage area is the largest. It begins in the mountains of the Ho-huan Range near $121^{\circ}16'$ E long., at an elevation of about 3300 m above sea level, and flows eastward into the sea via an alluvial fan between $120^{\circ}10'$ and $120^{\circ}20'$ E long. From south to north the area of the Choshui system ranges from $23^{\circ}30'$ to $24^{\circ}05'$ N lat. In administrative units the Choshui system covers the southern half of Nan-t'ou prefecture, the entire Chang-hua prefecture, and the northern edge of Yün-lin prefecture. To its north and slightly shorter (ca. 140 km long), the Tatu River begins in the mountains at $121^{\circ}12'$ E long. at an elevation of 2340 m, and flows into the sea at about $120^{\circ}29'$. It covers an area from $23^{\circ}50'$ to $24^{\circ}15'$ N lat. that includes the northern half of Nan-t'ou prefecture, T'ai-chung city, the southern part of T'ai-chung prefecture, and the northern edge of Chang-hua prefecture. The two river systems lie side by side north-south; their upper courses and tributaries have carved off a series of valleys and ravines in the Central Range, but in their lower courses form the common T'ai-chung basin and coastal plains area. The total area of the two river systems is about 5200 km², just about a seventh of the total area of the island (C. C. Lin 1966: 45-64; cf. C. H. Ch'en 1959-61).

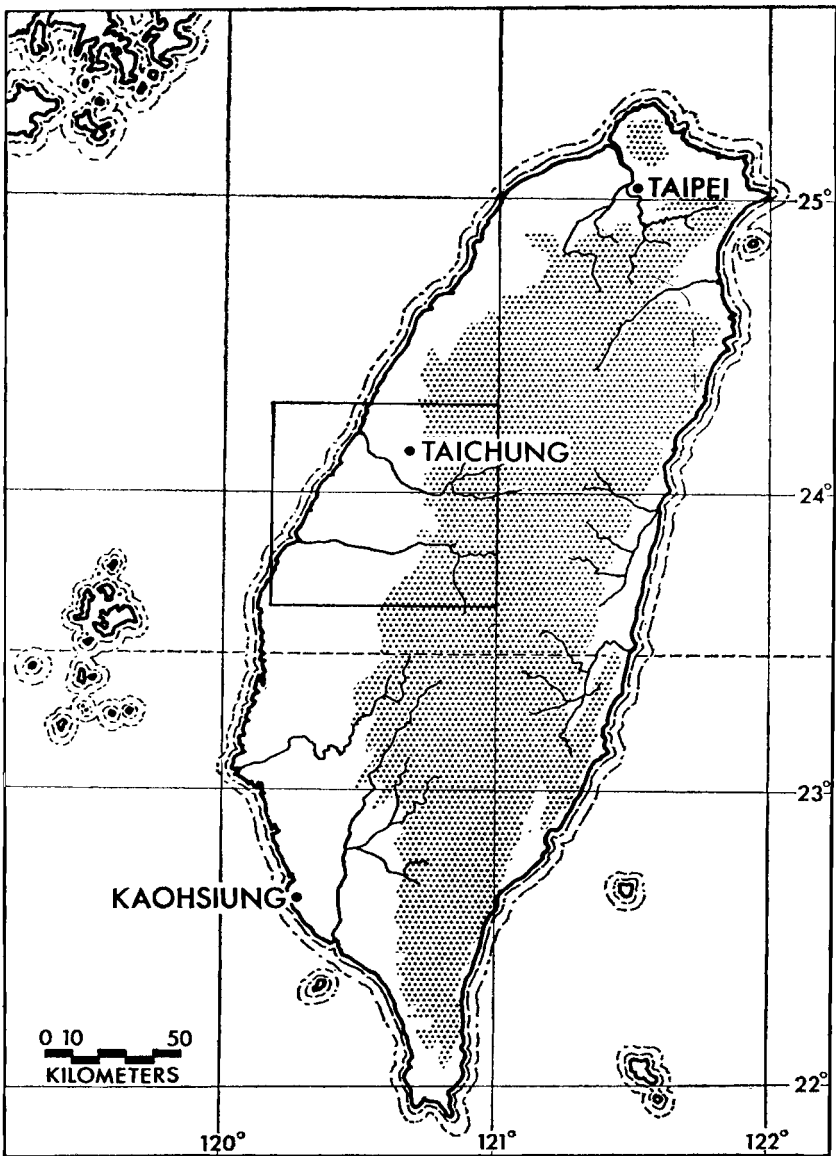


Fig. 1 Taiwan. The Choshui and Tatu River valleys are situated in the boxed-in area.

This area was occupied by aboriginal populations early in prehistory, but its historical beginnings came late. Taiwan fell under the rule of the Manchu dynasty in 1683. The next year the government established here one *fu* and three *hsien* units, the latter being T'ai-nan Hsien (the present-day T'ai-nan), Feng-shan Hsien (Kao-hsiung), and Chu-lo Hsien (Chia-yi). This indicates that at that time the large Chinese population centers were confined to the plains area between Chia-yi and Kao-hsiung, well to the south of our area. In 1723, T'ai-wan Fu was expanded to include another *hsien* and two *t'ing* units, the additional *hsien* being Chang-hua, in

the lower Choshui River valley. Subsequently, a series of Chinese immigrations and settlements took place, with the Chang-hua plain as a center of dispersal, bringing Chinese settlers upstream along both the Choshui and the Tatu (Ino 1928, part 1: 248-270; C. W. Liu 1958; H. L. Wei and C. C. Ch'iu 1968: 1-10). At the present time, the inhabitants of the area contain the following ethnic components:

The "Mountain Tribes." These are mainly the Atayal and Bunun peoples, who inhabit the mountainous areas of the Central Range. Both groups, whose total spheres of distribution are much larger than in our area, claim origin in the Choshui River valley, the Atayal (the Sediq branch) claiming the upper courses and the Bunun the middle course (Mabuchi 1953).

The "Plains Tribes." The Babuza and Hoanya peoples were known to have been in the Chang-hua plain, and the Paze and the Papora peoples lived in the T'ai-chung basin. Most of them have long been assimilated by the Chinese, but the Paze, who immigrated into the P'u-li basin in the early 19th century (C. W. Liu 1958), and the Thao of Sun-Moon Lake still retain some traditional culture and language.

The Han Chinese. Han Chinese of both Chang-chou and Ch'üan-chou dialect groups are found throughout the area, from the seacoast to the smallest of the mountain valleys. A small number of Hakka Chinese reside in Kuo-hsing Hsiang of Nan-t'ou.

Such variations of present-day cultures and inhabitants, accounted for by diverse historical origins to be sure, are at the same time closely tied together with the variations of the natural environment and available resources. Our area has mountains, hills, terraces, basins, and plains—or, more technically, each of the major geomorphological planes found on the island as a whole (C. C. Lin 1957, 1964). In altitude, our area has both the coastal plains and the tallest peak of the island, Yü Shan (3997 m). Consequently, the area offers a wide range of temperatures, and the annual mean temperature suffers a drop of 0.5°C with each increase of 100 m in altitude. For example, Ho-shê of Nan-t'ou Hsien at 985 m elevation has an annual mean temperature of 20.7°C and an annual precipitation of 2550 mm, but the annual mean temperature of Wei-shang at 2212 m elevation drops to 8.8°C and the annual precipitation increases to 3252 mm (P. N. Li 1966: 250). With temperature and precipitation changes go different plant covers; forests in the area range from the tropical-subtropical in the lowlands to the arctic in high altitudes (C. H. Ch'en 1966: 119; T. T. Wang 1966: 200).

An area of merely 5200 km² that encompasses such great diversity in temperature, rainfall, and plant cover obviously provides potential natural resources for a good many different kinds of cultures, and within our area one indeed sees many different patterns of the utilization of natural resources. To cite P'u-li, Yü-ch'ih, Jen-ai, and Hsin-yi (four administrative districts within Nan-t'ou Hsien) as examples: the first two districts are located in relatively low flat land and are inhabited for the most part by the Han Chinese and the assimilated Plains Tribes. The last two districts are in higher and more mountainous areas, inhabited by many people from the Mountain Tribes (79% of the Jen-ai population and 45.7% of the Hsin-yi population being of the Mountain Tribes; government census data of 1960, quoted from T. H. Sun 1966: 7, and C. H. Ch'en 1966: 127-128). In 1959, in P'u-li,

4042 hectares were used for rice and 689 hectares for sweet potatoes; in Yu-ch'ih, 1749 hectares for rice fields and 300 hectares for sweet potatoes. But in Jen-ai, only 942 hectares were used for rice and 624 hectares for sweet potatoes; 450 hectares were sown with millet. In Hsin-yi unit the corresponding figures were 855, 198, and 53 hectares respectively (C. H. Ch'en 1966: 134-135; for details see H. W. Wang 1967: 166 ff., H. W. Wang and S. C. Wang 1970, H. C. Chang 1966). The Atayal (pop. 6075, in Nan-t'ou) and Bunun (pop. 6359) groups in Jen-ai and Hsin-yi again differ in land use: of the Atayal of Taiwan as a whole, 28.4% inhabit land at 500-1000 m elevation, 34.5% at 1000-1500 m, and only 10.4% at 1500-2000 m; whereas 22.7% of Bunun live at 500-1000 m, 38.2% at 1000-1500 m, and as many as 26% at 1500-2000 m elevation (T. H. Sun 1966: 11; see also J. Y. Wang 1967). All of these figures clearly suggest that the differential use of the natural resources is an important criterion that distinguishes the cultural groups of this area.

The implications of this observation for culture-historical studies are obvious. The classification of most if not all ancient cultures was based upon material remains. Material culture, by definition, being the means by which ancient inhabitants coped with and made use of their environmental resources, archaeological remains may in fact indicate more patterns of resource utilization than historical origins. Furthermore, the geographical distribution of ancient cultures may easily represent active adaptation rather than migratory accident.

Thanks to the efforts of the staff of the Commission for Historical Research of Nan-t'ou Hsien, the Choshui and Tatu River valleys have yielded the richest natural and humanistic science data among all comparable regions on the island. Many of these findings are included in *Nan-t'ou Wen-hsien Ts'ung Chi* (vol. I, 1954-vol. XIX, 1972), which presents research results in soil analysis (C. C. Ch'en 1966), zoology (J. S. Liang 1966), geomorphology (C. C. Lin 1964), archaeology (C. W. Liu 1956a, 1956b; P. H. Liu 1954; P. H. Liu and C. W. Liu 1957; C. J. Shih 1956), ethnohistory (C. W. Liu 1958), botany (T. J. Liu and C. W. Liu 1956), climate (H. W. Wang 1967), agriculture (H. W. Wang and Y. C. Wang 1970), folk customs (Hung 1972), and ethnography of aboriginal tribes (H. L. Wei and C. C. Ch'iu 1968; C. L. Ch'en 1971). We are fortunate in having this very solid foundation on which to begin our work.

Serious modern research in this area in all of these fields is, nevertheless, just beginning. Firsthand investigations in all natural scientific fields have been few and far between. In archaeology, although as many as 176 sites were known by 1956 in Nan-t'ou Hsien alone (C. W. Liu 1956a: 55-73), only a handful had been excavated to any extent (see K. C. Chang et al. 1969: 202-208), and at least an initial reconnaissance of the whole area would be desirable. In ethnology, there was some conventional ethnographic material from the aboriginal groups in this area, but vigorous, theoretically sophisticated work such as the population and lineage studies that have been attempted elsewhere in Taiwan had yet to be extended to our area.

But our design differs most from what has been undertaken up to now in its comprehensive nature. Its breadth is not only intradisciplinary (for example, the study of the archaeology, the ethnohistory, and the ethnography of the modern inhabitants) but also interdisciplinary. Ours is a "saturation" approach; we investigate many natural and humanistic scientific aspects of a small region—two

river valleys—and seek to examine their interaction through a study of the ecosystems throughout their recent history. This will be a first attempt of the kind in Taiwan and its adjoining regions.

From the point of view of culture history, this attempt is long overdue. The solution—or the beginning of any solution—to many of the outstanding problems in the prehistoric archaeology of the Far East must depend upon palaeoenvironmental studies and upon valid reconstructions of ancient ecosystems. For example, some scholars see two major cycles of agricultural development in the Far East, an earlier one characterized by the cultivation of root and tuber crops, and a later one featuring such cereals as millet and rice (e.g., K. C. Chang 1970a; D. Yen 1971). The beginning of the second cycle in much of Southeast Asia has been fairly well established in the fourth and the third millennia B.C., but the beginning of the first cycle is still unclear. During this first cycle, subsistence still leaned heavily upon fishing and hunting, but incipient farming was apparent (Barrau 1970; K. C. Chang 1967; Sauer 1952). This argues for a diversified subsistence in which many kinds of resources were equally important to human life. Although the evidence from Taiwan (K. C. Chang et al. 1969) and Thailand (Gorman 1971) is beginning to shed light in this direction, an intensive study of an ecologically significant region has not yet been undertaken in the Far East for the purpose of elucidating the process of such diversified resource utilization or reconstructing the ancient ecosystem in which such activities took place. For studies along these lines our area offers great potential, as is shown by earlier palynological studies at Sun-Moon Lake (Tsukada 1966, 1967).

THE FIRST YEAR

The Choshui-Tatu work began in July 1972. Altogether about forty scholars from various fields participated in the research in the first year. Since some of these disciplines still lacked basic information, and because the participants must yet learn to work together in a project like this, the first phase of the project (1972–74) is one in which each of the disciplines is to design its own research with flexibility according to its own need. An integrated approach is not regarded as being desirable at this stage, and we are counting on the integrated nature of the evidence—in terms of the reality of human history—to provide the necessary background for the cohesion of the data and the conclusions produced by the project's independently operating disciplines. As for the interdisciplinary aspect, this is essentially the training phase, during which the scholars engage in the exchange of ideas and results, both informally and through two prescheduled semiannual conferences. As a result of the first year's work, we have already tentatively decided to design our next phase of research (1974–) around a small number of carefully selected subjects or problem areas. Teams of scientists would be organized around these areas, such as the history of settlement patterns, the history of Chinese colonization, local sequences of climatic changes, and the diverse models of cultural adaptation, and within each team there would be cultural anthropologists, geomorphologists, archaeologists, and/or other scientists as required by the nature of the problem and the evidence.

Thus, the work of the first year (1972–73) must be described within the framework of individual disciplines. Although only two papers have been published so

far of the results (S. H. Wang 1972; Chung, Huang, and Stamps 1973), the entire team's work has been described in a series of unpublished preliminary reports presented at the semiannual conferences that took place in Taipei in January and July 1973 (H. S. Ch'en 1973a, 1973b; M. T. Ch'en 1973a, 1973b; M. N. Cheng 1973a, 1973b; Y. C. Chuang 1973a, 1973b; C. K. Ho 1973a, 1973b; C. C. Hsieh 1973a, 1973b; C. M. Hsü 1973a, 1973b; S. C. Huang 1973a, 1973b; T. C. Huang and T. F. Chung 1973a, 1973b; J. S. Liang 1973; C. C. Lin et al. 1973; C. W. Liu 1973a, 1973b; Y. T. Liu and L. Y. Huang 1973; S. C. Lo 1973a, 1973b; T. T. Shih et al. 1973a, 1973b; Stamps 1973; P. K. Sun 1973a, 1973b, 1973c; C. H. Tsang 1973a, 1973b, 1973c; C. C. Wang and J. S. Liang 1973; S. H. Wang 1972, 1973a, 1973b). Here I can only touch upon a very small number of highlights.

The geological objectives were both structural and historical. Among other data, six cores in the P'u-li basins were collected. Two were taken at Wai-chia-tao-k'eng, one at the Yü-ch'ih basin, one at the bottom of Lake Jih-t'an, one at the bottom of Lake Yüeh-t'an, and one at the T'ou-shê basin. The Wai-chia-tao-k'eng cores reached to a depth of 170 m, providing exceedingly valuable data for the study of the geohistory and palaeobiology of the area. Soil and pollen studies of these cores are now in progress. Preliminary results show that peat deposits occur in all cases, indicating that these basins were lakes and ponds until quite recently. Seven radiocarbon samples have been processed. A date of 1480 B.P. is indicated by a sample at 1 m deep in the T'ou-shê basin, 4870 B.P. at 2 m, 3560 B.P. at 4 m, 3580 B.P. at 5 m, 7250 B.P. at 9 m; a sample taken at 15.5 m deep of the Jih-t'an core gives a date older than 30,000 years ago; and a date of 16,540 B.P. has been given by an 8 m sample of the Yüeh-t'an core. All of the T'ou-shê core samples were taken from the peat layers, which were more than 30 m thick. (All radiocarbon dates were provided by Hsü Yün-chi of NTU and were based on the half-life of 5570).

The first-year botanical work was confined to pollen analysis. The pollen work of the six cores mentioned above began toward the end of the first year; the botanists expect to complete at least one and probably two cores by the end of the second year. In addition, they processed the soil samples from four cuttings at three prehistoric sites in the P'u-li basin submitted by Richard Stamps, which have yielded some preliminary results for the ancient vegetation cover of that area (Chung, Huang, and Stamps 1973).

The geomorphologists confined their first-year work to the Tatu River valley. They see three clearly marked stages in the recent formation of the landform of the Tatu area:

(a) The Ta-tu and the Pa-kua terraces were connected, forming the western bank of the T'ai-chung basin, which was then a large lake. The P'u-li basins were then a series of lakes and ponds of various sizes. The Ta-tu system was, thus, much smaller than it is now: it flowed into Lake T'ai-chung near the modern town of Ts'ao-t'un. We do not yet have a time reference for this, but we are undoubtedly dealing with the Pleistocene period as defined for East Asia.

(b) Several thousand or—as is more likely—between ten and twenty thousand years ago, due probably to tectonic movement and climatic change, the water in many of the P'u-li lakes was drained out, leaving behind a series of basins. Rather

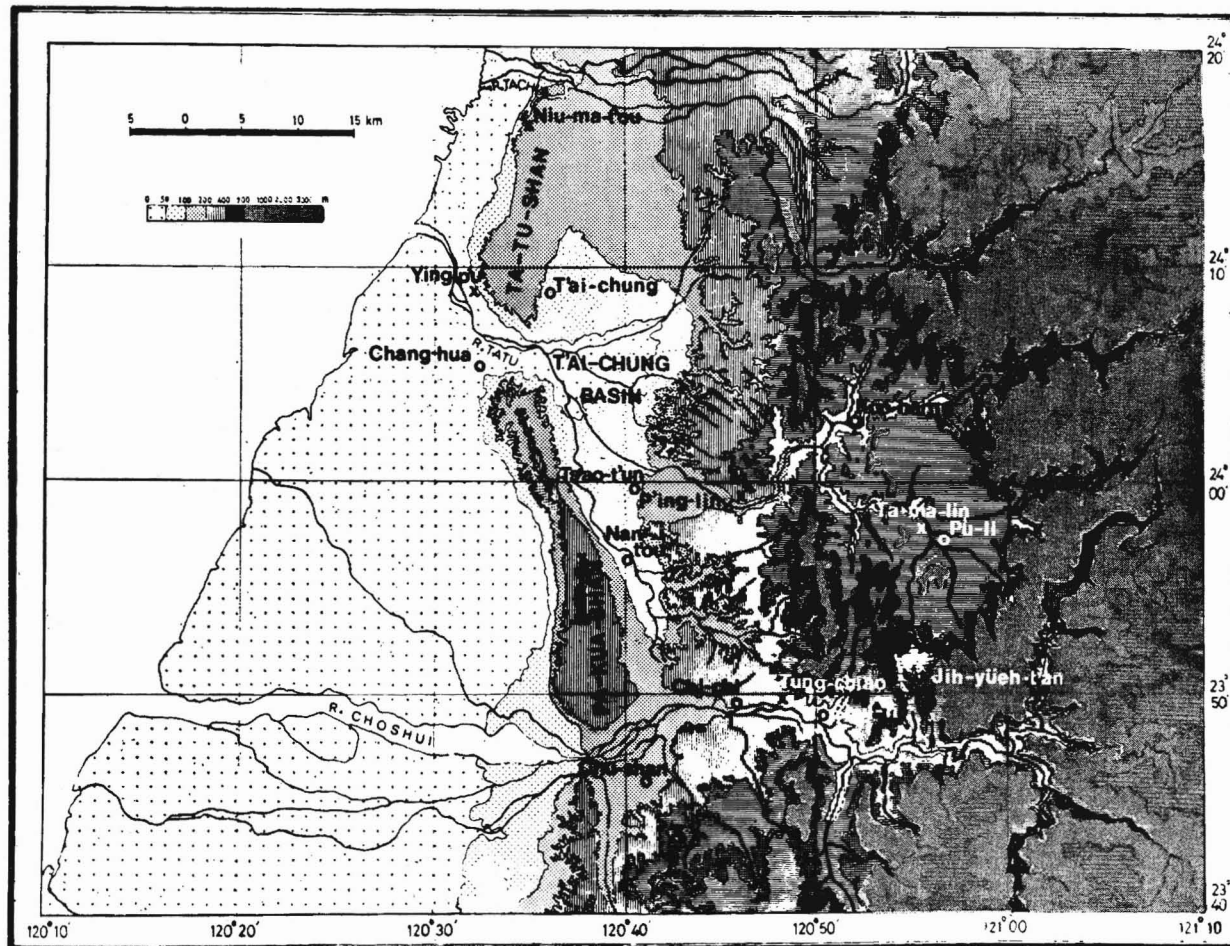


Fig. 2 Choshui-Tatu River valleys: principal cities and archaeological sites.

severe erosion took place along the banks of the Wu-hsi (middle Tatu) River, forming the higher terraces along the entire course of the river.

(c) Finally, perhaps within the last several thousand or just more than ten thousand years, partly as the result of eustasis of the coastal land, a gap appeared between the Ta-tu and the Pa-kua terraces, which transformed Lake T'ai-chung into an inland sea or a large lagoon. It was drained of water gradually, forming the lower terraces along the inner rims of the basin and the lower course of the Wu-hsi River.

The zoologists made an extensive collection of the native fauna of the area during the first year, concentrating in the mountainous regions of the upper courses of the Choshui and Tatu rivers. Also collected were native terms for the various animals and fishes in the many dialects spoken in the area.

The first-year objectives of the archaeologists were to locate prehistoric sites, collect sample artifacts from the surface and from test pits, and establish a preliminary cultural chronology of the entire area. The area where actual reconnaissance took place includes both the east and the west slopes of the Ta-tu terrace, the Ts'ao-t'un hills, the valley of the Wu-hsi River, Kuo-hsing district, the P'u-li basin, the Yü-ch'ih district, the valley of Choshui River near Chi-chi, the Nan-t'ou hills, the Chu-shan area, and the east and west slopes of the Pa-kua terrace (Fig. 2). No fewer than 267 prehistoric localities were found during the year. A chronological arrangement has been attempted according to ceramic seriation and radiocarbon dates.

Prehistoric potsherds of the entire area are tentatively grouped into five classes (cf. W. H. Sung 1965; K. C. Chang et al. 1969): Coarse Cord-marked; Red Cord-marked; Plain Red; Gray-Black; and Gray-Black Impressed. Arranging the sites by ceramic seriation results in the following sequence: (a) The earliest ceramic phase is represented by the Coarse Cord-marked; only two sites contain this earliest component, namely, the lower stratum of Niu-ma-t'ou and the lower stratum of P'ing-lin IV (Figs. 2 and 3). (b) The next ceramic phase is characterized by the

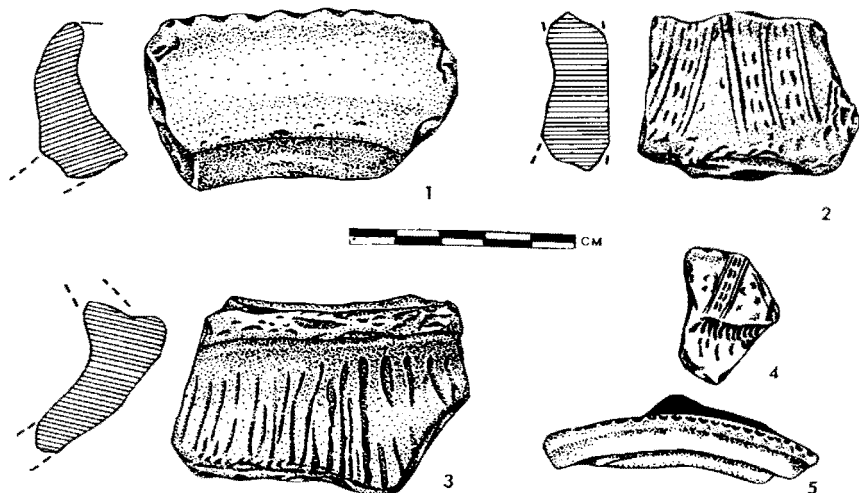


Fig. 3 Coarse Cord-marked pottery finds: 1, Niu-ma-t'ou, interior view of rim sherd; 2, Niu-ma-t'ou, exterior view of rim sherd; 3, P'ing-lin IV, exterior view of shoulder sherd; 4, 5, rim sherds from Ta-p'en-k'eng (4 and 5 not drawn to scale).

Red Cord-marked; it is distributed along both sides of the Ta-tu terrace and along the eastern rim of the T'ai-chung basin as far south as Ts'ao-t'un, or the mouth of the Wu-hsi River. (c) The Plain Red followed in time, and sites of this phase are seen over the entire T'ai-chung basin and have extended upward along the Wu-hsi River to the Kuo-hsing district and along the Choshui River to the neighborhood of Chi-chi. (d) The next phase is that of the Gray-Black, which is distributed in the same area as Plain Red but is further extended into the P'u-li basins. Compared with the sites of the Plain Red, sites of the Gray-Black are also seen on the higher as well as the lower terraces. Within the same region it is often found that Plain Red sites occur on lower terraces but Gray-Black sites on higher terraces. (e) Finally, the Gray-Black Impressed marks the latest prehistoric phase, which is found only sporadically and so far has been confined to the Ta-tu terrace and pockets in the mountain areas (such as the environs of the Tung-p'u village in the Ch'en-yu-lan River valley; see Treistman 1972) (Fig. 4).

During 1972-73 nine radiocarbon samples collected by Richard B. Stamps in the P'u-li basin were processed by the Radiocarbon Laboratory of NTU. All were associated with remains of the Gray-Black Pottery phase. The determinations are presented in Table 1. These dates may be viewed together with the other radiocarbon dates that have been previously obtained from archaeological sites in this area (Table 2) (Y. C. Hsü et al. 1970; Stuiver 1969; Treistman 1972). These carbon-14

TABLE 1. RADIOCARBON DATES FROM P'U-LI BASIN

NUMBER	LOCALITY	B.P. (HALF-LIFE = 5570)	B.P. (HALF-LIFE = 5730)	B.C. AND A.D. (HALF-LIFE= 5730)
NTU-201	P'u-li 30, C-2	3282±98	3380±100	1430±100 B.C.
NTU-203	P'u-li 30, G	3207±96	3300±100	1350±100 B.C.
NTU-202	P'u-li 30, D-2	2994±90	3080±90	1130±90 B.C.
NTU-200	P'u-li 29, B-3	2381±71	2450±70	500±70 B.C.
NTU-196	P'u-li 21, D-3	2197±66	2260±70	310±70 B.C.
NTU-195	P'u-li 21, D-5	2104±63	2165±70	215±70 B.C.
NTU-194	P'u-li 21	1846±55	1900±55	A.D. 50±55
NTU-193	P'u-li 21, B-4	1837±55	1890±55	A.D. 60±55
NTU-192	P'u-li 21, A-4	1783±53	1835±55	A.D. 115±55

TABLE 2. OTHER RADIOCARBON DATES FROM THE CHOSHUI-TATU AREA

NUMBER	SITE-CULTURE	B.P. (HALF-LIFE = 5570)	B.P. (HALF-LIFE = 5730)	B.C. and A.D. (HALF-LIFE= 5730)
Y-1630	Ying-p'u, Gray-Black Pottery	2970±80	3060±80	1110±80 B.C.
Y-1631	Ying-p'u, Gray-Black Pottery	2810±100	2890±100	940±100 B.C.
Y-1632	Ying-p'u, Gray-Black Pottery	2250±60	2320±60	370±60 B.C.
NTU-57	Tung-chiao, Plain Red and Gray-Black Pottery	3840±380	3960±390	2010±390 B.C.
NTU-56	Tung-chiao, Plain Red and Gray-Black Pottery	1630±160	1680±160	A.D. 270±160
GX-1538	Tung-p'u, Gray-Black Impressed	1165±110	1200±110	A.D. 750±110

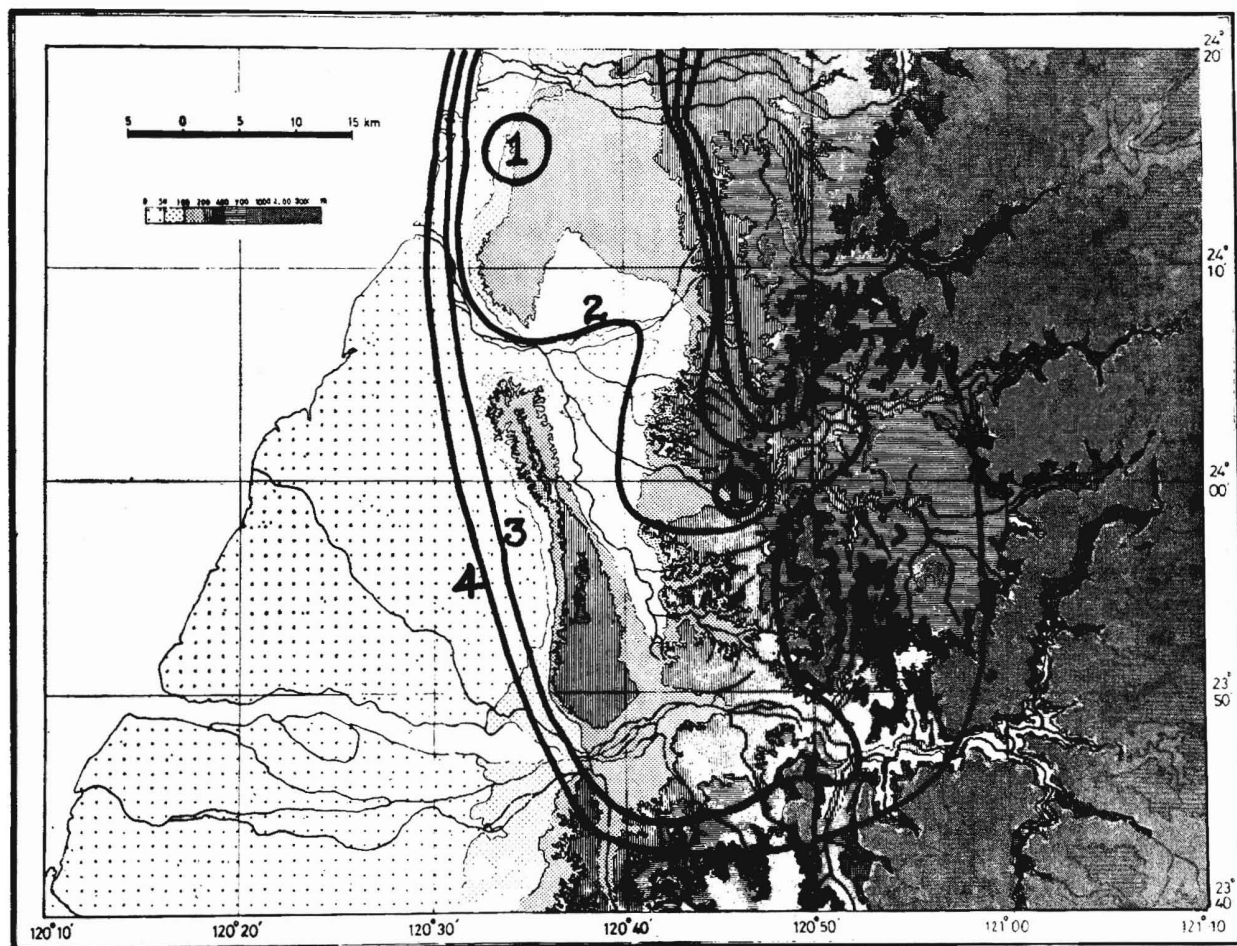


Fig. 4 Approximate distribution spheres of four prehistoric ceramic phases: 1, Coarse Cord-marked; 2, Red Cord-marked; 3, Plain Red; 4, Gray-Black.

dates are reasonably consistent with one another, except for the two Tung-chiao dates. The samples on which the dates were determined were submitted by Treistman. Her excavations at the site in 1968 have not been reported in print, and consequently we have no association information concerning these two dates. According to our knowledge of the Tung-chiao site, which has been described by previous authors (C. W. Liu 1956a: 47) and was repeatedly visited by me and the other archaeologists on the project, there is a strong possibility that it contains two separate components characterized respectively by Plain Red and by Gray-Black Pottery remains. Perhaps the two dates were related to the two separate components at the site. In any event, on the basis of the data described above, we may construct a tentative absolute chronology of the area as follows: (a) Coarse Cord-marked Pottery Phase: prior to 3000 B.C. (b) Red Cord-marked Pottery Phase: 2500–2000 B.C. (c) Plain Red Pottery Phase (with Gray-Black Pottery occurring): 2000–1500 B.C. (d) Gray-Black Pottery Phase (with Plain Red Pottery occurring): 1500 B.C.–A.D. 700 and after. (e) Gray-Black Impressed Pottery Phase: After A.D. 700 (local distribution only). To match this sequence against my earlier, coarser chronology for this area, on page 204 of K. C. Chang et al. 1969: (a) is new; (b) corresponds to the Niu-ma-t'ou horizon; (c) and (d) together correspond to the Ying-p'u horizon; and (e) to the Fan-tzu-yüan horizon. The new absolute dates will replace the older dates shown on page 216.

Here prehistory of the area extends easily down into the history of the Chinese culture. The Chinese colonization of the area may be marked by the year 1666 when General Liu Kuo-hsüan and his troops began their occupation on behalf of General Cheng Ch'eng-kung. As stated above, the Ch'ing dynasty government subjugated Taiwan in 1683, and in the next year it made Taiwan a *fu* and began to bring in large numbers of Chinese immigrants. The immigrants brought irrigated rice farming into this area, as shown by the initial construction of water-works in the plains and the basins area. The population pressure that gradually came about as a result must in large measure account for the frequent clan wars that began in the late 18th century and for the major migrations of the aboriginal groups during the 19th century. After 1850, foreign capital and the commercial capital within the area were thrown into agricultural production, resulting in the wide planting of sugarcane and camphors, and in the beginning of a transportation network for the produces. This may be referred to as the second major leap of the agriculture of the area. The third leap took place in 1905–20, during which time the Japanese completed some of the basic steps for a modern economy, such as the establishment of a land-tax system, the construction of the trunk railway, and the modernization of agricultural technology. The period 1920–40 saw another leap of agriculture, characterized by the vast improvement of the quality of rice, the use of chemical fertilizer, and the modernization of agricultural management. (This paragraph was based on personal communication, S. H. Wang.)

During 1972–73, the objective of the cultural anthropologists was to describe and explain the economic history of the area outlined above from both field research and historical study. These studies are providing important basic data in the pattern of the utilization of the diverse economic resources by the various ethnic groups and their various economic systems. These patterns in turn provide interpretive models for the study of prehistoric cultural variations.

GENERAL OBSERVATIONS

The overall long-term objective of the Choshui-Tatu Project is the study of cultural variation and change in relation to both the diversity and the changes in the natural environment and the adaptive capabilities of the human groups (K. C. Chang 1970*b*, 1971*a*, 1971*b*, 1973*a*, 1973*b*). This cannot be achieved without prolonged and concentrated research, but even during the first year of the first phase of the project preliminary syntheses must be attempted so as to provide guidance for current and future work. What has the first-year work told us about human history in the Choshui and Tatu River valleys? I can only present some of my own observations at this time.

The most prominent topographic feature of the Choshui and Tatu area during the Pleistocene period is probably the two lakes, one in the highlands and the other in the lowland. The latter is Lake T'ai-chung, bordered on the east by the Feng-yüan and Nan-t'ou hills, and on the west by the Ta-tu and Pa-kua terraces, at the time forming a continuous ridge. The highland lakes included at least Lake P'u-li, Lake Yü-ch'ih, Lake Jih-yüeh-t'an, Lake T'ou-shê, and Lake T'ung-kuei, which are now dry-bottomed basins except for Lake Jih-yüeh-t'an. The two principal rivers were the Wu-hsi River, which flowed into Lake T'ai-chung near Ts'ao-t'un, and the Choshui River, which flowed into the sea immediately after passing the southern end of the Pa-kua terrace. When this landform began to emerge and when it ended are still under study, but it was probably during this period that the higher terraces of the T'ai-chung basin were formed.

In 1964-65, as part of a Yale University-NTU prehistoric study in Taiwan, Matsuo Tsukada (1966, 1967) made a boring at the bottom of Lake Jih-t'an to a depth of 12.79 m. (The new boring of 1973 at the same locus reached the bedrock at a much greater depth.) Studies of the fossil pollens and spores from this core convinced Tsukada that in the late Pleistocene Taiwan experienced a cold climatic phase that corresponds to the Ta-li glacial period of South China. At the peak of the glaciation the mean annual temperature at Jih-t'an was perhaps 8-11° C lower than that of the present. Even low-lying areas to the west probably had frost during winters. From then on, however, there began a steady temperature increase until 3000-8000 years ago, when the annual mean temperature was probably 2 or 3 degrees C above that of the present level. This—hypsithermal—was the period when man first came to our area.

Sometime after the temperature began its rise from the glacial nadir, as the result of a number of interacting factors (among them heavy rainfall and tectonic movement being probably the most important), the water in most of the highland lakes began to drain off, leaving behind—excepting Jih-yüeh-t'an—a number of basins, the P'u-li basins. This event, or series of events, took place perhaps ten or twenty thousand years ago. The peat deposits that we found in the cores in the P'u-li basins were lake-bottom deposits, and their dating will help determine the sequence of draining of the various lakes. Some time after that, the Ta-tu and Pa-kua terraces became separated, and Lake T'ai-chung was turned into a saltwater lagoon. Beginning seven or eight thousand years ago, sea water began a gradual withdrawal from the lagoon, forming the lower terraces along the rims of the T'ai-chung basin, and these lower terraces were the principal stages of the first human activities.

In our present knowledge, man reached this area during the period 3000–6000 B.C., well within the above-mentioned hypsithermal. Man probably found here an area with a higher temperature than now, moist and rainy, covered in low altitudes with a subtropical vegetation. The lower reaches of the T'ai-chung basin were still covered with sea water, but the lower terraces along the rims already began to be formed and to emerge. On these coastal terraces man undoubtedly encountered habitable land areas with easy access to a rather large diversity of natural resources. At this time many of the P'u-li lakes had been drained, but others still contained water. The Wu-hsi River joined the sea near Ts'ao-t'un, and the Choshui River flowed into the Taiwan Strait between the modern towns of Ming-chien and Chu-shan. But the inhabitants of the area at the time (having perhaps come down from the north along the coast) probably were confined to the seashore terraces. Only two sites in this area have yielded remains of this period, the Niu-ma-t'ou site of Ch'ing-shui (on the west side of the Ta-tu terrace) and the P'ing-lin IV site of Ts'ao-t'un. These are the major archaeological finds of the first year; at these sites Coarse Cord-marked potsherds of the Ta-p'en-k'eng type (K. C. Chang et al. 1969: 166–170) were collected from the surface, indicating the first occupation of this area at a greater antiquity than was hitherto known. (No reliable absolute dates are available for the Corded Ware stratum at Ta-p'en-k'eng. In July 1972, Huang Shih-ch'iang [NTU] and I visited a newly discovered site of this culture near Pa-chia-ts'un, in the Kuei-jen district of T'ai-nan prefecture, east of the city of T'ai-nan, about 100 km south of our area. On the riverbed of Hsü-hsien Creek were widely strewn potsherds, stones, bones and antlers, and molluscan shells, probably exposed by recent erosion. All remains apparently came from a single component of the Ta-p'en-k'eng culture. An oyster shell collected here has yielded a radiocarbon date of 5480 ± 55 [half-life=5568] or 5645 ± 60 [=5730] B.P. at the Radiocarbon Laboratory of the Smithsonian Institution [SI-1229]. I thank Dr. Robert Stuckenrath for this information.)

One of the major foci of our second-year research is information pertaining to the exploitation of natural resources on the part of the people at this time who used the Coarse Cord-marked pottery. Earlier we referred to their "habitable land areas with easy access to a rather large diversity of natural resources." What were the resources within the environs of their villages? The word "environs" can perhaps be defined as the area in which the villagers routinely walked within each day to carry out their essential subsistence activities. Cheng Ming-neng of the zoology group told me that according to his own experience and observation, a zoological collector can walk 35 km each day in the mountains of Nan-t'ou, but that a farmer usually does not walk more than 8 km each day to and back from his field. The range of the sort with which an ancient hunter-fisher-farmer came into contact was in all likelihood larger than that for a modern farmer, but a 10-km radius of land travel may seem to be a reasonable estimate for the average villager. Coastal dwellers, however, were presumably able to enlarge this radius by a considerable margin through the use of boats. Within this spatial range of the land and sea activities, what kinds of natural resources were accessible to the people at this time? Which were actually exploited? How did the people and the natural resources interlock into a meaningful ecosystem?

Studies attempting to answer questions of this kind are currently going on, and

they are important for reasons that go beyond the Choshui and Tatu River valleys. The T'ai-chung Bay environment described above bears a strong resemblance to the kind of environment envisioned by Sauer (1952) to be the hearth of the first farmers of Southeast Asia, and I am increasingly convinced that the people of Taiwan and the southeastern coasts of China and Indochina, whose cultural inventory is characterized by the Coarse Cord-marked pottery of the Ta-p'en-k'eng type (K. C. Chang 1967), were among the earliest cultivators of Southeast Asia. It is unlikely that the transition from food-gathering to food-producing that took place in Southeast Asia took place first in our Choshui and Tatu River valleys. This area is, however, one of the very few areas of South China and Southeast Asia where interdisciplinary research groups are working out the elemental ingredients necessary for ecosystemic studies. The cultural ecology of the Coarse Cord-marked pottery people in this area would thus be of more than provincial interest. In addition, the people here may not have initiated the crucial transition to farming, but they probably participated in it as member communities of a cultural horizon that covered a much larger area. Whatever illumination our data here can shed on the beginning of farming in this small region can also shed light on the crucial event or series of events throughout monsoon Southeast Asia. For these reasons we are concentrating much of our work during the second year in the collection of data for these purposes. The same approaches of study are, of course, applicable to the cultural phases subsequent to the Coarse Cord-marked pottery. But because a larger geographic space is involved, an even more complex environment must be taken into account. According to preliminary observations, the human history of the Choshui and Tatu River valleys subsequent to the Coarse Cord-marked pottery may be broken down into the following phases:

(1) 2500–2000 B.C. This is the period when the Lungshanoid grain cultures entered our area, and the type site is the fine, red, cord-marked pottery stratum at Niu-ma-t'ou, in Ch'ing-shui (P. H. Liu 1955). There are many more sites of this—Red Cord-marked pottery—phase than of the previous one, but they are still confined to the lower terraces in the northern part of the T'ai-chung basin, concentrated in the slopes of the Ta-tu terrace and the hills north of Ts'ao-t'un. According to geomorphological observations, the lower terraces of the T'ai-chung basin were still being formed, but some of them had probably begun to emerge as sea water was making a gradual retreat.

(2) 2000–1500 B.C., characterized by a predominance of Plain Red pottery, is a period of vast expansion of the populations. Sites of this period not only occur widely around the rims of the T'ai-chung basin, but also had penetrated upcourse to the western part of the Kuo-hsing district in the Wu-hsi valley and to the area between Shui-li and Chi-chi in the Choshui valley. This means that in addition to ceramic change, the cultures of this period also underwent adaptive changes from coastal terraces to the highlands and interior river valleys. These changes are presumably reflected in the exploitative activities exhibited at prehistoric sites. For example, the proportions of various kinds of fishing and of hunting activities on the coast and in the interior should exhibit significant differences.

(3) After 1500 B.C., Gray-Black pottery predominated at prehistoric sites, three of which are the best known: Ying-p'u, Ta-ma-lin, and Tung-chiao. The subsequent

pattern of settlement shows three noteworthy characteristics: sites are increasingly denser; they are distributed more widely, extending further upward and into the interior, reaching into the P'u-li basins; and sites are found on the higher terraces as well as on the lower terraces. These phenomena can be attributed to at least two factors: a greater population density and a larger number of settlements, and a culture possessing perhaps a greater flexibility or range of capabilities, which enabled the inhabitants to adapt to a larger variety of natural environments. Where did they obtain this flexibility—from improved exploitative technology or from the introduction of new and more adaptable crops? We hope to be able to answer this question before very long. But there is little doubt that the foundation of the aboriginal populations in this area was laid down largely during the period characterized by the Gray-Black pottery.*

(4) From about A.D. 700, a new ceramic culture emerged in the area near the mouth of the Ta-chia River, north of the Ta-tu terrace. This is the Gray-Black pottery with impressed and comb-incised decorative patterns, typified by the site at Fan-tzu-yüan, in T'ieh-chan-shan, near Ta-chia (C. J. Shih and W. H. Sung 1956). Sites of this kind appear to be confined to the northern edges of the T'ai-chung basin, but similar potsherds have been reported from Tung-p'u high up in the Ch'en-yu-lan River valley. Possibly, because of population pressure that already existed in the lowlands and low hills, the new culture made sporadic penetrations into the higher altitudes. Treistman (1972) pointed out that in prehistoric Taiwan one can recognize a highland and a lowland pattern of cultural adaptation, although, as has been shown, the adaptive patterns in the prehistoric Choshui and Tatu River valleys were more complex and diverse than can be summarized by a highland-lowland dichotomy.

(5) Beginning around 1700, the Han Chinese descended upon the stage, as has been described above. The principal modern ethnic groups in this area included the Fukienese, the Hakkas, and the Fukienized Hakkas among the Han Chinese; the Babuza, the Hoanya, the Paze, the Papora, and the Thao, of the "Plains Tribes"; and the Atayal and the Bunun of the "Mountain Tribes." To be sure, the Chinese are the most technologically advanced, have the most people, and are the most powerful politically. But the lifeways of each of the groups must have their own adaptive significance, and their respective ecological niches together form a certain symbiotic interrelationship. If each or some of the ethnic groups engage or have engaged in the specialized exploitation of unique resources, a trade network within the area is presumable and can be proved. In this regard, the cultural anthropologists are faced with some especially interesting issues. Among them are the problem of continuity from archaeological cultures to ethnographical groups; the ways in which the contact between the Han Chinese and the aborigines affected their respective (but especially the latter's) adaptive behavior; and the cultural ecology of each of the ethnic groups. One major gap in our first-year archaeological

* If the P'u-li basins (including Lake Jih-yüeh-t'an) were not inhabited until this phase, and if the people having the Coarse Cord-marked pottery were confined to the coast, then the deforestation shown on Tsukada's pollen core at Lake Jih-t'an at 12,000 B.P. could not have been caused by slash-and-burn farming of the Coarse Cord-marked pottery people, as I believed (K. C. Chang 1967; K. C. Chang et al. 1969). I refrain from making a final judgment on the matter until there is more excavated material, but the above point should now be noted.

work, which has important bearing on some of these problems, is the historical archaeology of the Han Chinese. This will be a major research topic in a subsequent phase of the project.

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